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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/753,608  | 01/08/2004  | Robert L. Fair       | 112056-0148         | 6334             |
| 24267   | 7590        | 10/03/2006           | EXAMINER            |                  |
| CESARI AND MCKENNA, LLP<br>88 BLACK FALCON AVENUE<br>BOSTON, MA 02210 |             |                      |                     | MOORE, PATRICK M |
|   |             | ART UNIT             |                     | PAPER NUMBER     |
|   |             |                      |                     | 2188             |

DATE MAILED: 10/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |
|------------------------------|------------------------|---------------------|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |
|                              | 10/753,608             | FAIR, ROBERT L.     |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |
|                              | Patrick M. Moore       | 2188                |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 25 May 2006.  
 2a) This action is FINAL.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-53 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 1-53 is/are rejected.  
 7) Claim(s) \_\_\_\_\_ is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 25 May 2006 is/are: a) accepted or b) objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 5) <input type="checkbox"/> Notice of Informal Patent Application |
|  | 6) <input type="checkbox"/> Other: _____                          |

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### DETAILED ACTION

1. Claims 1, 6, 8, 10, 16, 20, 22, 26 & 28 have been amended.
2. Claims 30-53 are newly presented.
3. Claims 1-53 have been examined.

#### *Drawings*

4. The drawings were received on **25 May 2006**. These drawings are not acceptable.

The amended drawings do not contain labels indicating whether each is a "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). Furthermore, Examiner notes that the newly presented drawings differ from the originally filed drawings in at least **Figures #1, #9, #10 & #12**, as filed on **25 May 2006**. Additionally, Applicant is reminded that all changes to drawings must be in either the drawing amendments section or remarks section of an amendment paper. See the following section for further information.

5. Appropriately corrected drawings are required.

### INFORMATION ON HOW TO EFFECT DRAWING CHANGES

#### **Replacement Drawing Sheets**

Drawing changes must be made by presenting replacement sheets which incorporate the desired changes and which comply with 37 CFR 1.84. An explanation of the changes made must be presented either in the drawing amendments section, or remarks, section of the amendment paper. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). A replacement sheet must include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of the amended drawing(s) must not be labeled as "amended." If the changes to the drawing figure(s) are not accepted by the examiner, applicant will be notified of any required corrective action in the next Office action. No further drawing submission will be required, unless applicant is notified.

Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and within the top margin.

### **Annotated Drawing Sheets**

A marked-up copy of any amended drawing figure, including annotations indicating the changes made, may be submitted or required by the examiner. The annotated drawing sheet(s) must be clearly labeled as "Annotated Sheet" and must be presented in the amendment or remarks section that explains the change(s) to the drawings.

### **Timing of Corrections**

Applicant is required to submit acceptable corrected drawings within the time period set in the Office action. See 37 CFR 1.85(a). Failure to take corrective action within the set period will result in ABANDONMENT of the application.

If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings MUST be filed within the THREE MONTH shortened statutory period set for reply in the "Notice of Allowability." Extensions of time may NOT be obtained under the provisions of 37 CFR 1.136 for filing the corrected drawings after the mailing of a Notice of Allowability.

### ***Response to Amendment***

6. Applicant's amendments and arguments submitted on 25 May 2006, in response to the Office Action mailed on 22 March 2006, have been fully considered with the result that follows.

### ***Claim Rejections - 35 USC § 102***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claims 1-14 & 16-53 are rejected under 35 U.S.C. 102(b) as being anticipates by Permut et al. (US Patent # 6,260,115), herein Permut.
- a. As per **Claim 1**, Permut discloses a method for a storage operating system implemented in a storage system to optimize the amount of readahead data

retrieved for a read stream established in a data container stored in the storage system, the method comprising: receiving a client read request at the storage system, the client read request indicating client-requested data for the storage operating system to retrieve from the data container containing the read stream [Figure 7A, #700]; determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the received client read request [Figure 7A, #702]; if it is determined that the storage operating system is permitted to retrieve readahead data from the data container [**"Yes" branch of Figure 7A, #702 & #704**], performing the steps of: (i) selecting an amount of readahead data to retrieve from the data container based on a plurality of factors [**"Yes" branch of Figure 7A, #704 & Figure 7B, #720**]; and (ii) retrieving the selected amount of readahead data from the data container [Figure 7B, #729, Column 3, Lines 31-49, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59].

b. As per **Claim 2**, Permut further discloses the method of claim 1, wherein the data container is a file, directory, vdisk or lun [Column 1, Lines 12-33 & Column

2, Lines 29-48].

c. As per **Claim 3**, Permut further discloses the method of claim 1, wherein the storage operating system is determined to be permitted to retrieve readahead data from the data container when the client-requested data extends the read stream past a predetermined next readahead value [Figure 7B, #722, #732, #734 & Column 11, Lines 38-48].

- d. As per **Claim 4**, Permut further discloses the method of claim 3, wherein the predetermined next readahead value is stored in a readset data structure associated with the read stream [**Figure 2, #200, #204, #210 & Column 11, Lines 38-48**].
- e. As per **Claim 5**, Permut further discloses the method of claim 3, wherein the predetermined next readahead value is updated based on a percentage of the selected amount of readahead data [**Figure 7B, #740, #742, #744 & Column 11, Line 60 – Column 12, Line 12**].
- f. As per **Claim 6**, Permut further discloses the method of claim 1, wherein a read-access style associated with the data container is one of the plurality of factors used to select the amount of readahead data [**Figure 2, #206 & Column 4, Lines 30-39**].
- g. As per **Claim 7**, Permut further discloses the method of claim 6, wherein the selected amount of readahead data equals zero if the read-access style corresponds to a random read-access style [**Column 2, Lines 51-66, Column 4, Lines 40-52 & Column 6, Lines 16-47**].
- h. As per **Claim 8**, Permut further discloses the method of claim 1, wherein a number of client read requests processed in the read stream is one of the plurality of factors used to select the amount of readahead data [**Column 4, Lines 53-67**].

- i. As per **Claim 9**, Permut further discloses the method of claim 8, wherein the number of client read requests processed in the read stream is stored as a count value in a readset data structure associated with the read stream [**Figure 2, #208**].
- j. As per **Claim 10**, Permut further discloses the method of claim 1, wherein the amount of client-requested data is one of the plurality of factors used to select the amount of readahead data [**Column 5, Lines 1-6**].
- k. As per **Claim 11**, Permut further discloses the method of claim 10, wherein the selected amount of readahead data is set equal to a predetermined upper limit for large amounts of client-requested data [**Column 4, Lines 7-21**].
- l. As per **Claim 12**, Permut further discloses the method of claim 1, wherein the selected amount of readahead data is doubled if the number of client read requests processed in the read stream is greater than a first threshold value [**Column 10, Lines 47-59**].
- m. As per **Claim 13**, Permut further discloses the method of claim 1, wherein the client-requested data is identified as read-once data when either (i) the number of client read requests processed in the read stream is greater than a second threshold value [**Figure 2, #208 & Column 4, Lines 6-21**] or (ii) a set of metadata associated with the read stream indicates that the client-requested data is read-once data [**Figure 2, #206 & Column 11, Lines 38-48**]. Examiner understands an entry's position on a candidate list, as disclosed by Permut; to be

functionally equivalent to “metadata” claimed by applicant because they both identify read-once data requested from a client.

n. As per **Claim 14**, Permut further discloses the method of claim 1, wherein the selected amount of readahead data is stored in one or more buffers enqueued on a flush queue, the flush queue being configured to reuse buffers after a predetermined period of time [**Column 3, Lines 11-30 & Column 5, Lines 15-18**].

o. As per **Claim 16**, Permut discloses an apparatus configured to implement a storage operating system that optimizes the amount of readahead data retrieved for a read stream established in a data container stored in the apparatus, the apparatus comprising: means for receiving a client read request, the client read request indicating client-requested data for the storage operating system to retrieve from the data container containing the read stream [**Column 3, Lines 31-49**]; means for determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the received client read request [**Figure 7A, #702**]; means for selecting an amount of readahead data to retrieve from the data container based on a plurality of factors [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and means for retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].

p. **Claims 17, 23 & 29** are rejected under identical grounds as **Claim 2**.

- q. **Claims 18 & 24** are rejected under identical grounds as **Claim 3**.
- r. **Claims 19 & 25** are rejected under identical grounds as **Claim 5**.
- s. As per **Claim 20**, Permut further discloses the apparatus of claim 16, wherein the plurality of factors used to select the amount of readahead data includes at least one of: (i) the amount of client-requested data [**Column 5, Lines 1-6**], (ii) a number of client read requests processed in the read stream [**Column 4, Lines 53-67**], and (iii) a read-access style associated with the data container [**Figure 2, #206 & Column 4, Lines 30-39**].
- t. As per **Claim 21**, Permut further discloses the apparatus of claim 16, wherein the selected amount of readahead data is doubled if the number of client read requests processed in the read stream is greater than a first threshold value [**Column 10, Lines 47-59**].
- u. As per **Claim 22**, Permut discloses a storage system configured to optimize the amount of readahead data retrieved for a read stream established in a data container stored in the storage system, the storage system comprising: a network adapter for receiving a client read request, the client read request indicating client-requested data to retrieve from the data container containing the read stream [**Column 3, Lines 31-49**]; and a memory configured to store instructions for implementing a storage operating system [**Column 1, Lines 19-22**] that performs the steps of: determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the

received client read request [Figure 7A, #702], and if it is determined that the storage operating system is permitted to retrieve readahead data from the data container [**“Yes” branch of Figure 7A, #702 & #704**]: (i) selecting an amount of readahead data to retrieve from the data container based on a plurality of factors [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and (ii) retrieving the selected amount of readahead data from the data container [Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59]. Examiner understands that it is well known in the art that a network adapter is an inherent component of the system taught by Permut.

v. As per **Claim 26**, Permut further discloses the storage system of claim 22, wherein the plurality of factors used to select the amount of readahead data includes at least one of: (i) the amount of client-requested data [Column 5, Lines 1-6], (ii) a number of client read requests processed in the read stream [Column 4, Lines 53-67], and (iii) a read-access style associated with the data container [Figure 2, #206 & Column 4, Lines 30-39].

w. As per **Claim 27**, Permut further discloses the storage system of claim 22, wherein the selected amount of readahead data is doubled if the number of client read requests processed in the read stream is greater than a first threshold value [Column 10, Lines 47-59].

x. As per **Claim 28**, Permut discloses a computer-readable media comprising instructions for execution in a processor for the practice of a method for a storage

operating system implemented in a storage system to optimize the amount of readahead data retrieved for a read stream established in a data container stored in the storage system, the method comprising: receiving a client read request at the storage system, the client read request indicating client-requested data for the storage operating system to retrieve from the data container containing the read stream [**Column 3, Lines 31-49**]; determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the received client read request [**Figure 7A, #702**]; if it is determined that the storage operating system is permitted to retrieve readahead data from the data container [**"Yes" branch of Figure 7A, #702 & #704**], performing the steps of: (i) selecting an amount of readahead data to retrieve from the data container based on a plurality of factors [**"Yes" branch of Figure 7A, #704 & Figure 7B, #720**]; and (ii) retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].

- y. **Claims 30, 32, 33, 45, 47, 48, 50, 52 & 53** are rejected under identical grounds as **Claim 14**.
- z. **Claims 31, 46 & 51** are rejected under identical grounds as **Claim 13**.
  - aa. As per **Claim 34**, Permut discloses a method for optimizing readahead data retrieval for a read stream established in a data container stored in a storage system, the method comprising: receiving a client read request at the storage

system, the client read request belonging to the read stream and indicating an amount of client-requested data [Column 3, Lines 31-49]; selecting an amount of readahead data based on the indicated amount of client-requested data [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].

bb. **Claims 35 & 36** are rejected under identical grounds as **Claim 12**.

cc. As per **Claim 37**, Permut further discloses the method of claim 36, further comprising the step of rounding, the selected amount of readahead data to the size of a data block [Column 1, Lines 55-59]. *Examiner understands that Permut teaches prestaging whole data blocks, which would inherently require a rounding step to achieve such prestaging.*

dd. **Claim 38** is rejected under identical grounds as **Claim 11**.

ee. As per **Claim 39**, Permut discloses a method for optimizing readahead data retrieval for a read stream established in a data container stored in a storage system, the method comprising: receiving a client read request at the storage system, the client read request belonging to the read stream and indicating client-requested data [Column 3, Lines 31-49]; selecting an amount of readahead data based on a read-access style associated with the data container [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**], and retrieving the

selected amount of readahead data from the data container [Figure 7B, #729,  
**Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59].**

ff. **Claim 40** is rejected under identical grounds as **Claim 7**.

gg. As per **Claim 41**, Permut discloses a method for optimizing readahead data retrieval for a read stream established in a data container stored in a storage system associated with a number of storage devices, the method comprising: receiving a client read request at the storage system, the client read request belonging to the read stream [**Column 3, Lines 31-49**] and indicating client-requested data; selecting an amount of readahead data based on the number of storage devices [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].

hh. As per **Claim 42**, Permut further discloses the method of claim 41, wherein the step of selecting an amount of readahead data further comprises: determining whether a flag is associated with the read stream [**Figure 2, #202**], the flag indicating that the storage system is associated with more than a predetermined number of storage devices [**Column 9, Lines 46**]; and in response to determining whether the flag is associated, selecting the amount of readahead data [**Column 9, Lines 43-56**]. *Examiner understands that Permut sets the Flags 202 to active/inactive depending on whether the entry is*

*referenced by the storage systems and is functionally equivalent to the flags claimed by Applicant.*

- ii. **Claim 43** is rejected under identical grounds as **Claim 2**.
- jj. As per **Claim 44**, Permut discloses a method for optimizing readahead data retrieval for a read stream established in a data container stored in a storage system, the method comprising: receiving a client read request at the storage system, the client read request belonging to the read stream and indicating client-requested data [**Column 3, Lines 31-49**]; selecting an amount of readahead data based on a plurality of factors [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].
- kk. As per **Claim 49**, Permut discloses a system for optimizing readahead data retrieval for a read stream established in a data container stored in a storage system, the system comprising: means for receiving a client read request at the storage system, the client read request belonging to the read stream and indicating client-requested data [**Column 3, Lines 31-49**]; means for selecting, an amount of readahead data based on a plurality of factors [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and means for retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].

***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Permut et al. (US Patent # 6,260,115) as applied to Claims 1 & 14 above, and further in view of Vishlitzky et al. (US Patent # 5,649,156), herein Vishlitzky.

- a. As per **Claim 15**, Permut does not expressly disclose a 2 second queue refresh period. However, Vishlitzky discloses the method of claim 14, wherein the predetermined period of time equals two seconds [**Column 7, Lines 41-52**]. Furthermore, Permut and Vishlitzky are analogous art because they are from the same problem solving area: Prefetch cache optimization in multi-stream data storage systems.
- b. At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify the sequential prestaging queue flush, as taught by Permut, to refresh with a period of 2 seconds, as taught by Vishlitzky to be well known in the art. The suggestion/motivation for doing so would have been for the benefit of balancing a minimum amount of open storage and a maximize amount of data stored in the queue, as taught by Permut in **Column 2, Line 51 - Column 3, Line 10**, and because after 2 seconds of inactivity, the chances are small that data will not be accessed again within a reasonable period of time, as taught by Vishlitzky.

***Response to Arguments***

9. Applicant's arguments filed **25 May 2006** have been fully considered but they are not persuasive. With respect to Applicant's Arguments to traverse the rejections set forth in the Office Action mailed on **22 March 2006**, Permut discloses selecting an amount of readahead data based on a plurality of factors. Specifically, Permut points out "The number of tracks... may vary for different scenarios such as different sequential hints, different command types or recent history of sequential patterns that indicate that sequential access is likely to continue." **[Column 2, Lines 13-19]**. Examiner understands Permut's specific anticipation of Applicant's claimed "*plurality of factors*" in, at least, the disclosure of multiple hints provided by a host: "Host sequential hints indicate that the application is likely to access data sequentially for some number of tracks or blocks" **[Column 8, Lines 60-63]**. Furthermore, Permut suggests a plurality of hints that can dictate the amount of readahead data: command eligibility **[per Column 8, Lines 53-57]**, Locate Record Domain **[as per Column 8, Line 67-Column 9, Line 3]**. Finally, as noted by Applicant's Arguments, Permut also discloses using several states (that may include "candidate", "sequential" or "very sequential") to dictate the amount of data tracks to prestage. Therefore, Applicant has expressly pointed out, in the response filed **25 May 2006**, at least two factors taught by Permut that are used to select an amount of readahead data.

### ***Conclusion***

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick M. Moore whose telephone number is (571) 272-1239. The examiner can normally be reached on M-F 8:30AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabahn can be reached on (571) 272-4210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PMM

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SUPERVISORY PATENT EXAMINER  
7/29/06